

Cyclodextrin glycosyltransferase biosynthesis by genetically engineered fermentative *Lactococcus lactis* in aerobic system

ABSTRACT

Lactococcus lactis is a facultative anaerobe famous for its fermentative metabolism. Its applications in different industries such as chemical, food and pharmaceuticals followed by its Generally Recognized as Safe status as well as being a model lactic acid bacterium and an interesting candidate for heterologous protein production/secretion have made this bacterium interesting to be investigated under different conditions. *L. lactis* has been traditionally employed in dairy and other food industries to produce fermented products. Therefore, research about *L. lactis* has been directed toward fermentation metabolism. Despite the classification of *L. lactis* as a facultative anaerobe, besides availability of extensive number of studies on its fermentative metabolism, some studies have pointed its ability to undergo respiratory growth in presence of a key chemical component in aerated cultures. It should be noted that *L. lactis* has been isolated from some plants. Intrinsically and in retrospect, it is not surprising if they endure and function under aerobic and respirative conditions. The key component for successful respiration of *L. lactis* is hemin. It is based on the fact that hemin cofactor is the only component being missed from the respiration electron transport chain in cell membrane of *L. lactis*. Therefore, *L. lactis* metabolic flux can be redirected to aerobic respiration by addition of hemin to the growth medium in presence of oxygen. It has been reported that aerobic respiration of *L. lactis* with the aid of hemin results in higher growth and biomass concentration, long-term survival and robustness. It is very applicable, as slow growth rate of *L. lactis* could be the single most important parameter making it less competitive protein expression system as compared to some industrially common strains such as *Escherichia coli*. Unfortunately, studies on *L. lactis* protein production under respiration conditions are very rare. While, there are various heterologous proteins being produced by recombinant *L. lactis*. Additionally, there is not enough information available about genetically engineered *L. lactis* behavior under aerobic respirative conditions, despite the fact that such interesting studies can lead to evolution in sciences and industries related to this strain.

Keyword: Recombinant *Lactococcus lactis*; Aerobic system; Respiration; Fermentation; Cyclodextrin glycosyltransferase